The CALICE experiment at MTBF (FNAL)

summary of a fruitful test beam experiment

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On behalf of CALICE

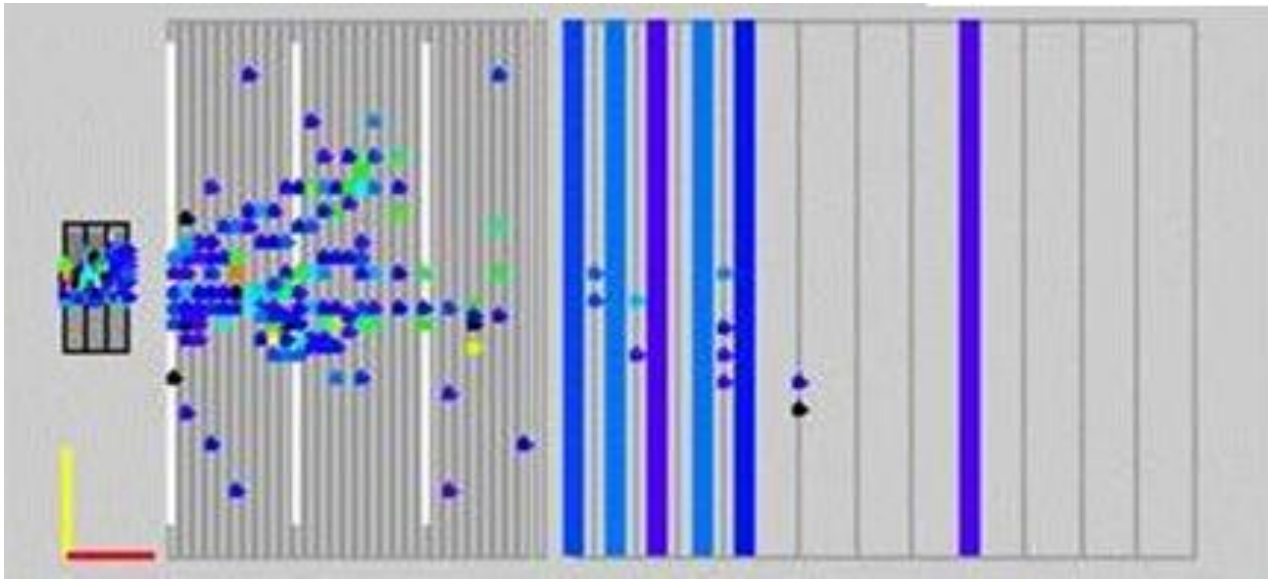
The CALICE detectors

Two major run configurations:

- Si-W ECAL + Analog HCAL + TCMT (May & July 08)
- Scint-W ECAL + Analog HCAL + TCMT (Sept. 08 & May 09)

Next to come:

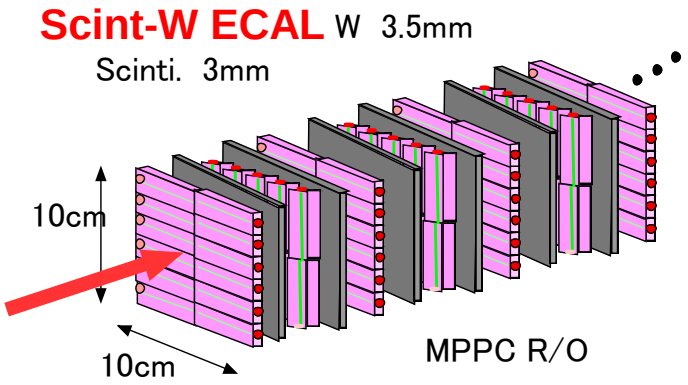
- Si-W ECAL + Digital HCAL + TCMT (end of 2009)



Online event display of 10GeV pion in Si-W ECAL+ AHCAL+TCMT

The test beam prototypes

1x1cm^2 lateral segmentation
1 X_0 longitudinal segmentation
~10000 channels



1x4.5cm^2 lateral segmentation
1 X_0 longitudinal segmentation
~ 600 channels

goal of prototype calorimeters:

- establish the technology
- collect hadronic showers data with unprecedented granularity to:
  - tune reco. Algorithms
  - validate MC models

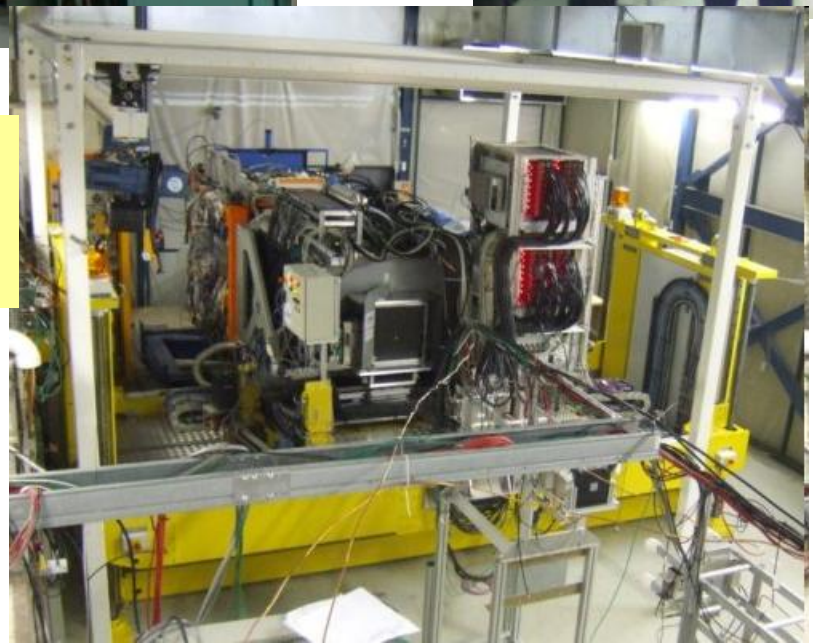
3x3cm^2 lateral segmentation
~4.5 λ in 38 layers
~8000 channels

5x100cm^2 strips
~5 λ in 16 layer

Technical aspects: installation

Flying the CALICE stage into the M6 area

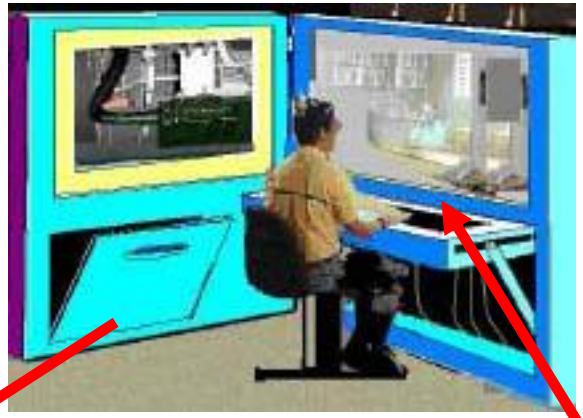
the CALICE installation with Si-W ECAL + AHCAL + TCMT

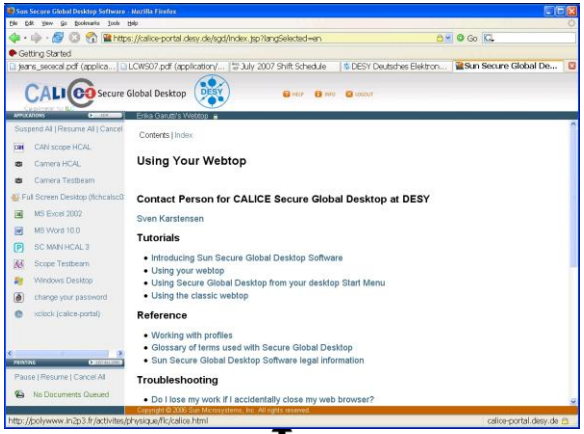


world-wide:

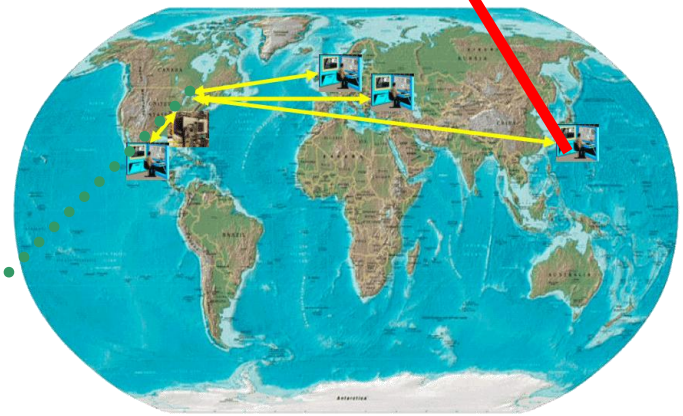
Established use of sophisticated system for remote control of detector & online monitor from around the globe

➔ Thank you FNAL for making it possible!

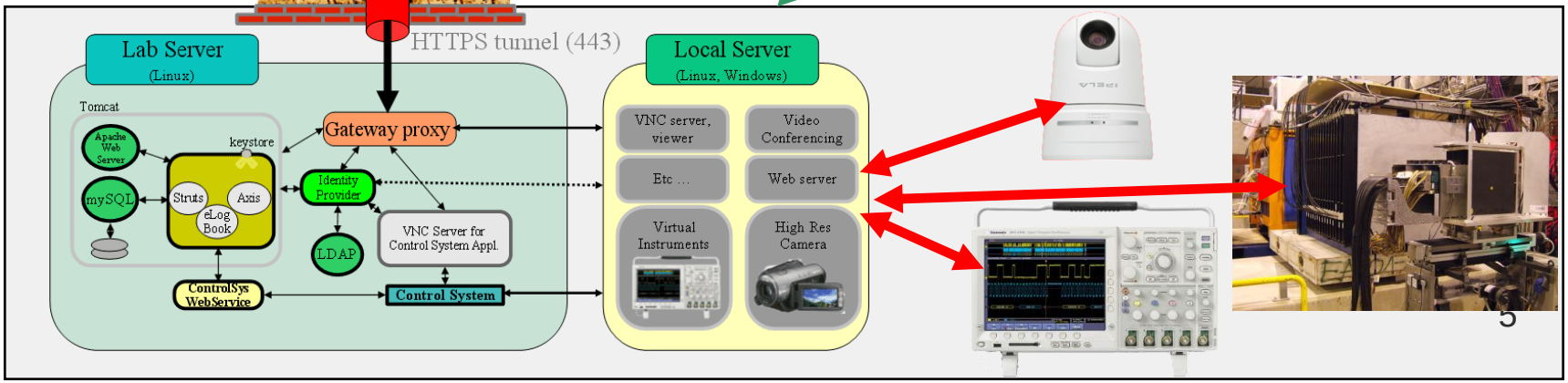




Access via web-port

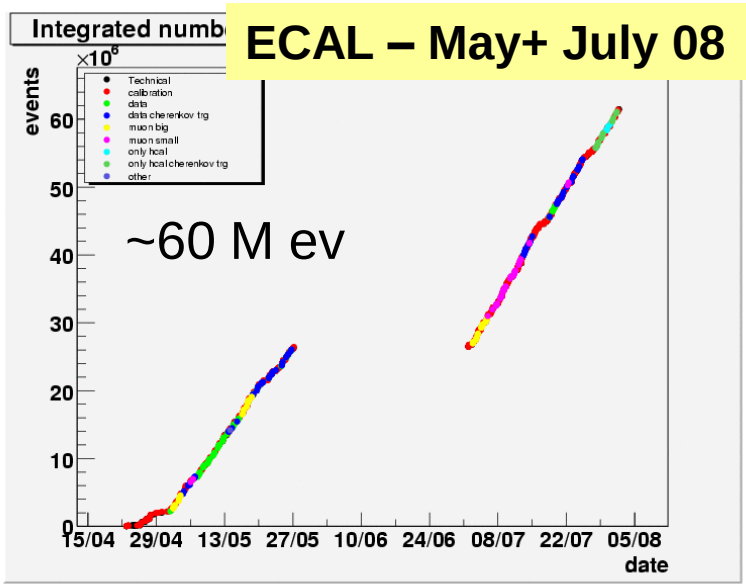


CALICE virtual control room

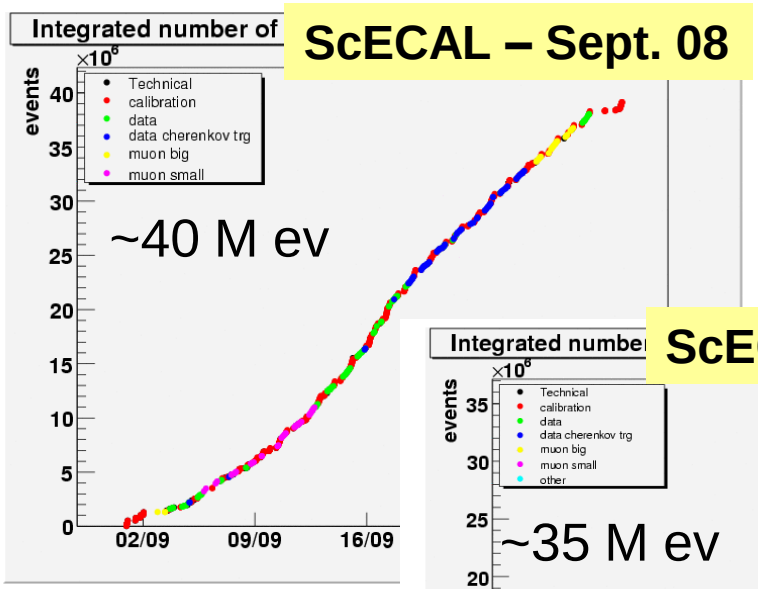


Data taking at FNAL

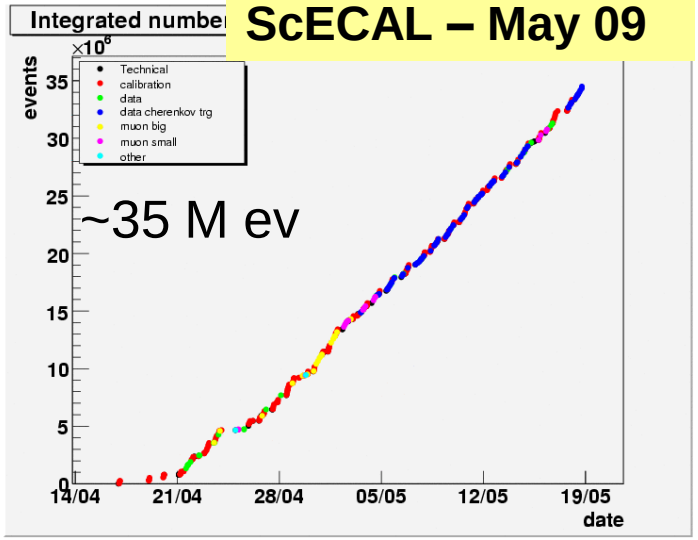
ECAL – May+ July 08



ScECAL – Sept. 08



ScECAL – May 09

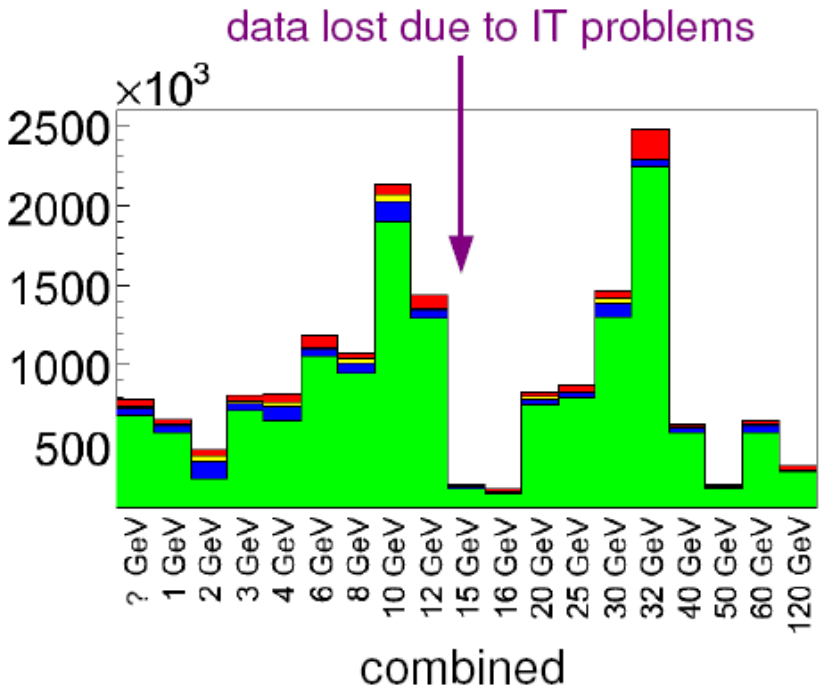


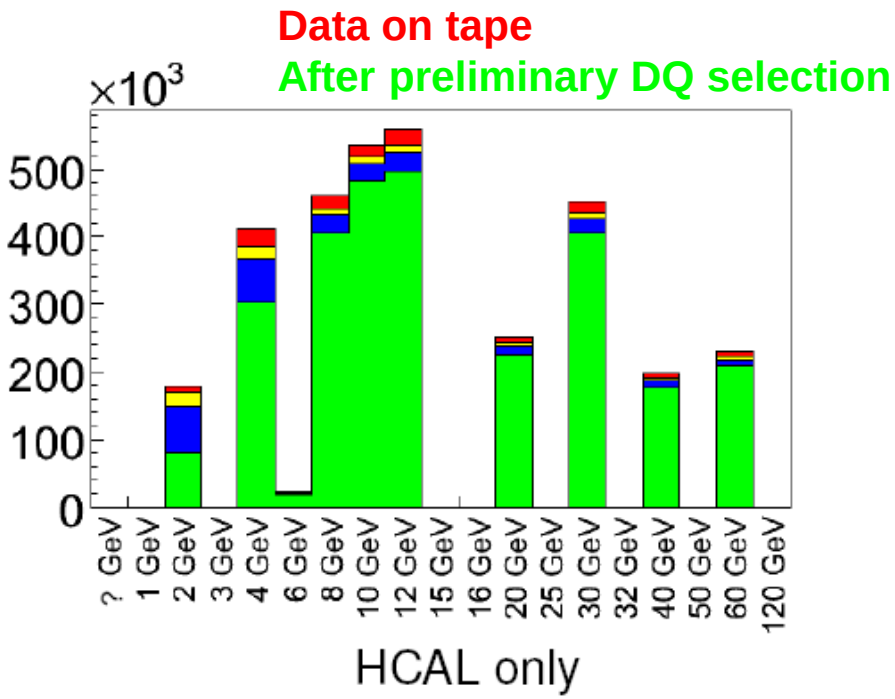
Smooth data taking after initial commissioning phase

~60 M events collected with Si-W ECAL + AHCAL (same as at CERN 07)

~75 M events with Sc-W ECAL + AHCAL (first time tested)

Data quality on FNAL data





Plots include ONLY pion runs from FNAL 08 both with ECAL and ScECAL

➔ Good coverage of all energy range 1-60 GeV

➔ Good performance of our detectors:

less than 10% events rejected by Data Quality

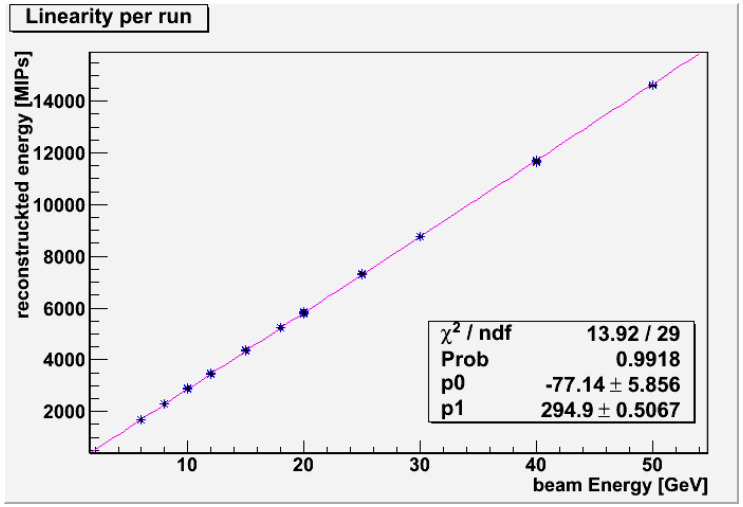
Suggestion for the user docu

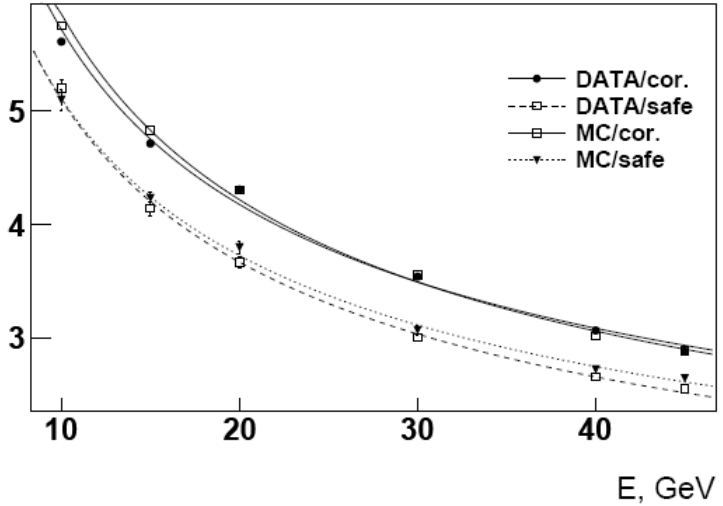
Maybe FNAL could consider to provide to the MTBF user some useful info on the users web page. Suggestions:

- Web page with updated Cherenkov pressure scans for “all” energies with clear “suggestions” which pressure to use for which particle type (takes a long time to perform)
- More info on muon energy spectrum/multiplicity for 32 GeV and 120 GeV beam (requires simulation of beamline)

Some ongoing Si-W ECAL analysis

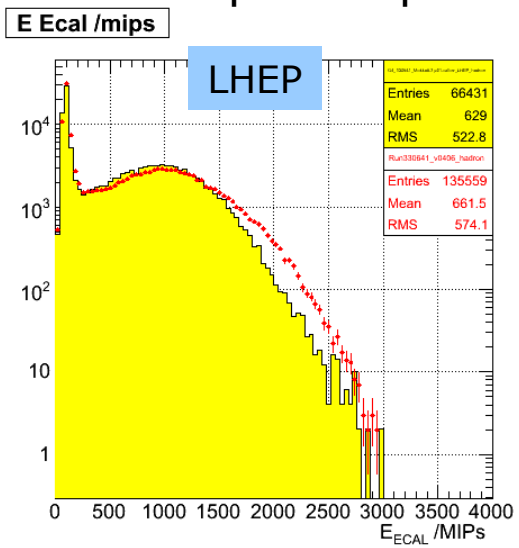
The standards: linearity & energy resolution

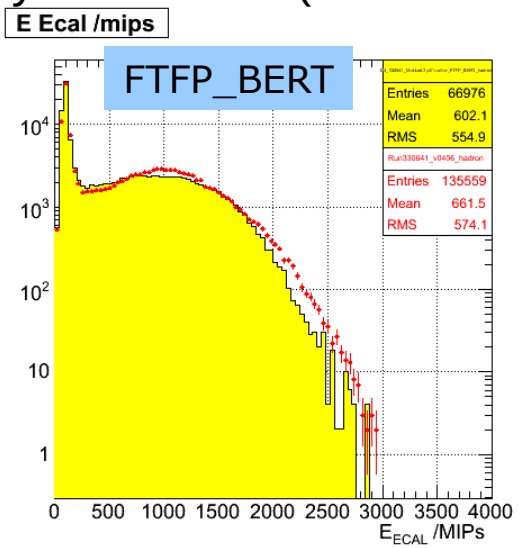


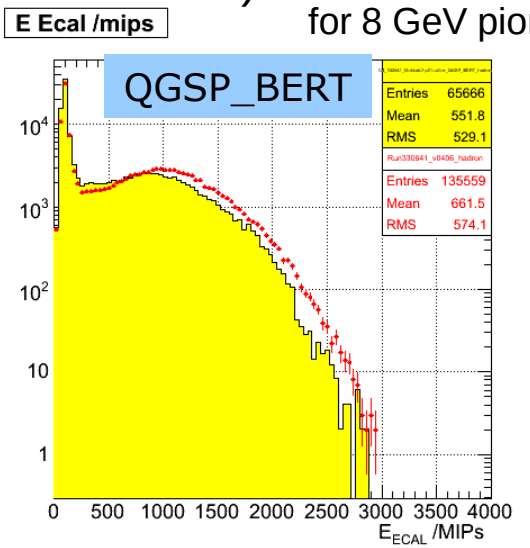


More complex: pion analysis in ECAL (validation of MC models)

total ECAL energy for 8 GeV pion



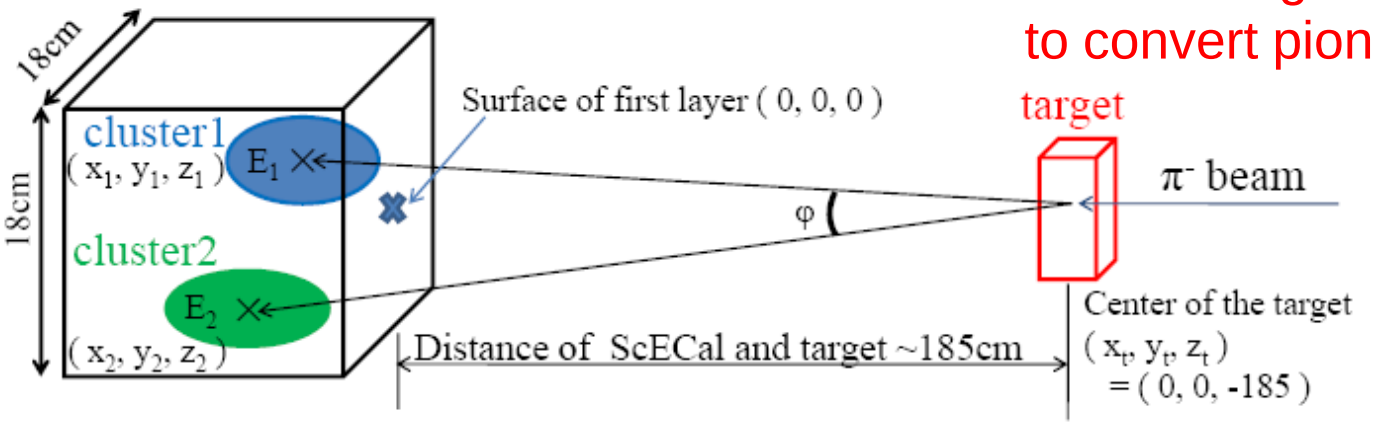




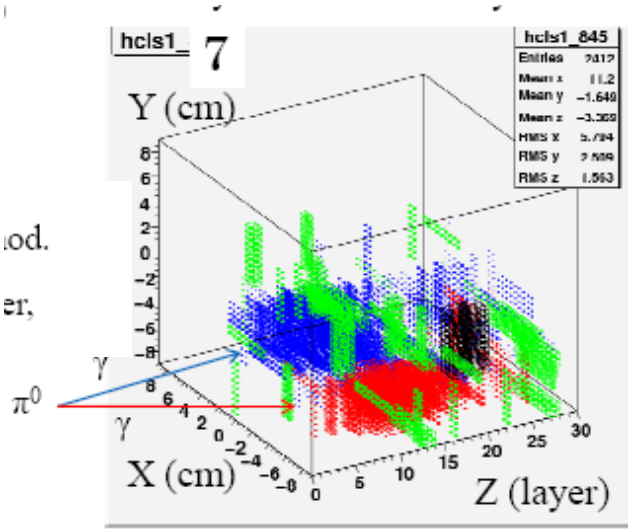
Some ongoing Sci-W ECAL analysis

reconstruction of π^0 from 2 γ clusters

Insert a target in the beamline to convert pion beam into π^0

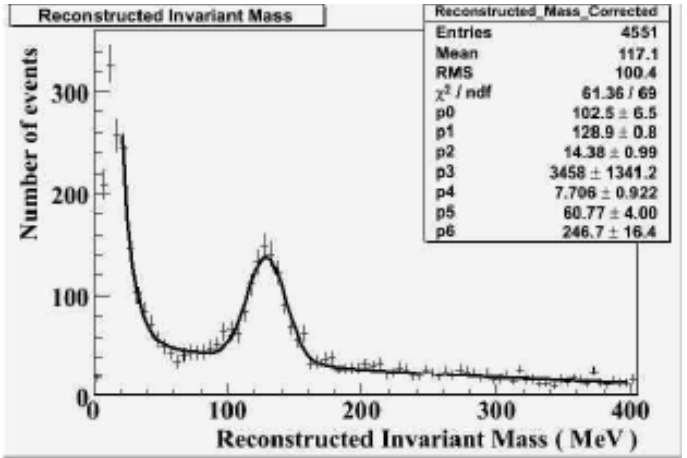


(Invariant Mass) = sqrt(2*E_1*E_2*(1-cos(φ)))



← real event

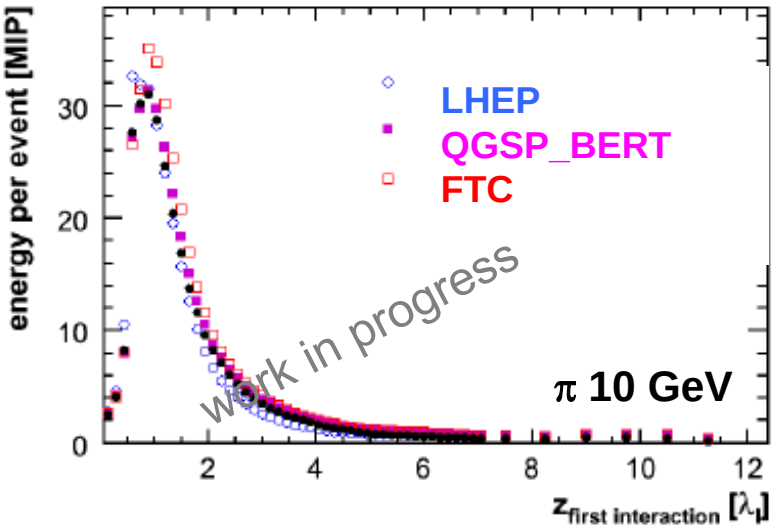
reconstructed π^0 mass



Some AHCAL ongoing analysis

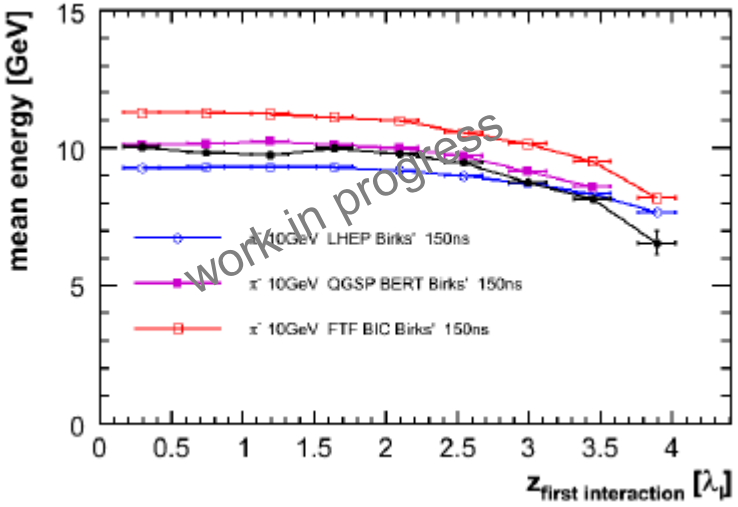
Analysis goal: validation of MC hadronic models

Longitudinal shower shape

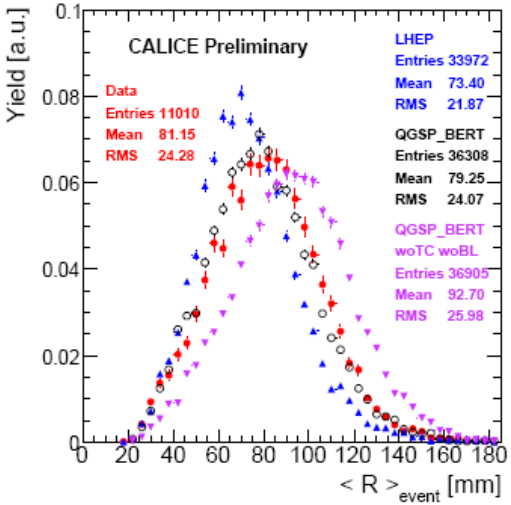


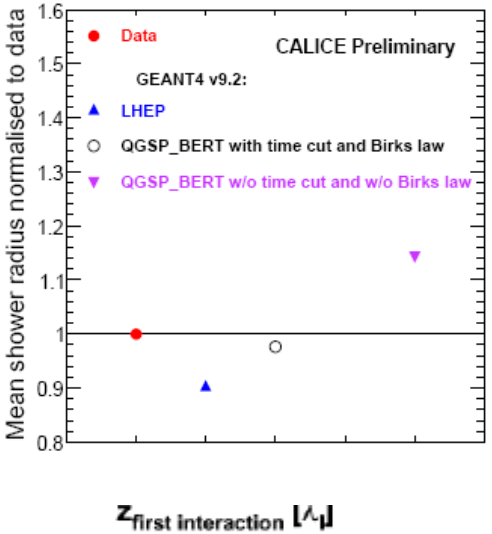
Geant4 9.2

Shower leakage

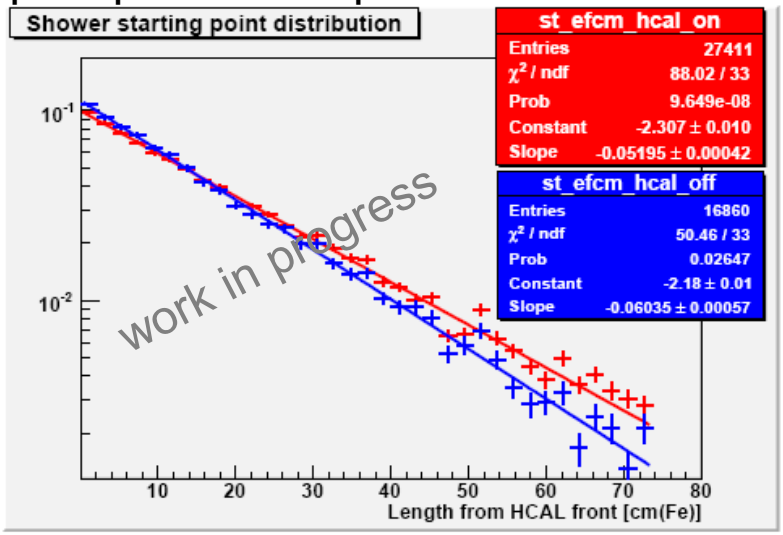


Lateral shower shape



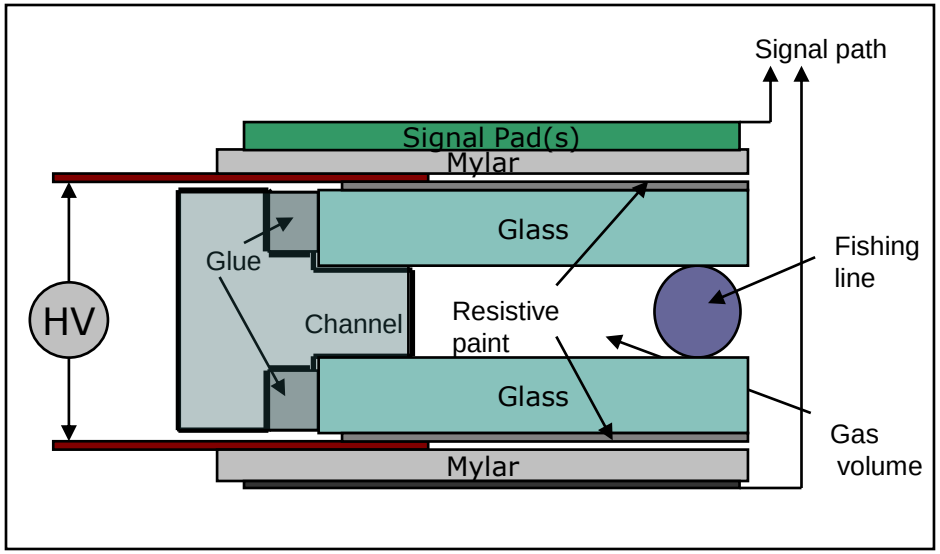


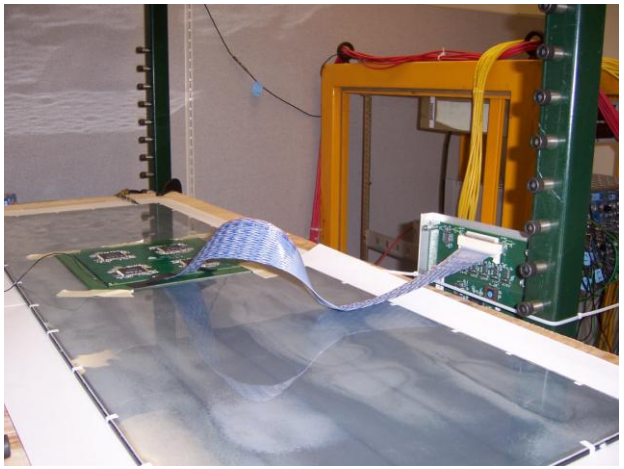
pion/proton comparison



Next steps

- Exchange the active layers of the AHCAL with the DHCAL ones
- Go for the final test beam campaign





cassettes with resistive plate chambers and GEM are being build and tested

expected to be ready by end of 2009 for installation in absorber frame

➔ Compare technologies for ECAL / HCAL with data from the same test beam

Conclusion

- The FNAL test beam was a successful campaign for CALICE
- We go home with a lot of high quality data and a lot of gained experience
- CALICE will continue tests at the MTBF ➔ DHCAL installation planned end of 2009

We thank
FNAL for the kind hospitality,
the machine group and the test beam technical support group for their continuous help and support

and in particular
Thank you to Erik for being an indispensable contact, and an excellent information source and problem solver!

BACKUP

Achieved HCAL program

	compared to run plan:
• Energy scan with pion / electron	ok
• Position scan with electrons	too few position points
• Angular scan	e ok / pi only @ 30 deg, few E points
• Displaced pion	only 2 runs (~ 4 planned) ok
• Proton run	ok
• Very low energy point	EXTRA !

… just as an example of plan/reality ➔ ~80% of the program achieved

Summary of AHCAL stand alone run 20-26 May 2009

E [GeV}	particle	center	edge	corner	displaced	10 deg	30 deg
-1	pi	50 k ev					
-2	pi	300 k ev					
-4	pi	380 k ev					
10	pi	200 k ev			200 k ev		150 k ev
20	pi				200 k ev		
30	pi						200 k ev
10	p	200 k ev					
15	p	100 k ev					
-1	e	140 k ev					
-2	e	200 k ev				150 k ev	90 k ev
-4	e	200 k ev				150 k ev	150 k ev
-6	e	200 k ev				150 k ev	140 k ev
-10	e	200 k ev	200 k ev	200 k ev			140 k ev
-20	e	300 k ev	200 k ev	200 k ev		150 k ev	200 k ev

too few points

too few points